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(54) Calcium-supplemented beverages and beverage concentrates containing low levels of sulfate.

(57) Beverages and beverage concentrates nutritionally supplemented with significant levels of solubilized calcium and containing low levels of sulfate, preferably in combination with low levels of chloride, are disclosed. These beverages and concentrates also contain specified levels of acids selected from phosphoric acid, citric acid, malic acid, fumaric acid, adipic acid, gluconic acid, and lactic acid, as well as mixtures of these acids. The particular acid systems are selected to provide the desired flavor and sourness character for the beverages and concentrates. Inclusion of low levels of sulfate/chloride in these beverages and concentrates provides a quicker onset of sourness, prevents or reduces aftertaste effects and improves the solubility of the calcium, particularly when high levels of phosphoric acid or citric acid are used. Inclusion of sulfate/chloride also prevents or reduces the precipitation and deposition of calcium salts on equipment surfaces during the pasteurization or sterilization of calcium-containing fruit juice beverages.

EP 0 301 653 A1

CALCIUM-SUPPLEMENTED BEVERAGES AND BEVERAGE CONCENTRATES CONTAINING LOW LEVELS OF SULFATE

TECHNICAL FIELD

This application relates to beverages and beverage concentrates for preparing same which are nutritionally supplemented with significant levels of calcium. This application particularly relates to calcium-supplemented beverages and beverage concentrates which contain low levels of sulfate, preferably in combination with low levels of chloride.

Dietary calcium inadequacy may be a contributing cause to osteoporosis, at least for some populations. For example, a positive correlation between calcium intake and bone mass has been found across many age groups. It has also been suggested that the level of calcium intake early in life directly influences the peak bone mass achieved at skeletal maturity.

During the period of late teenage to young adulthood, it has been found that a significant reduction in dietary calcium intake typically occurs. This is especially true of the female population where reduced dietary calcium intake usually happens much earlier in life compared to their male counterparts. Accordingly, females, as a class, are especially susceptible to a prolonged calcium deficit over their life span. This calcium deficit may be one reason for the greater incidence of osteoporosis in postmenopausal women.

Calcium can be obtained from a variety of dietary sources. The primary sources of calcium are dairy products, in particular milk. Milk provides a very valuable source of dietary calcium. However, beginning in young adulthood and continuing through later life, milk is typically not consumed in sufficient quantities by the general population to obtain needed levels of calcium. This may be caused by the unattractiveness of milk as a drink for "social occasions." Indeed, it has been found that teenage girls, and especially young adult women, generally find milk to be a socially unattractive drink, as well as too caloric and unappealing in taste.

To achieve greater consumption of calcium, a more appealing alternative to milk is apparently needed. This alternative must be one which is consumed in sufficient quantities to provide nutritionally beneficial amounts of calcium. Products which are consumed in great quantities by teenagers and young adults are carbonated soft drinks. Unlike milk, soft drinks can be formulated with a variety of flavors generated by natural flavor oils, flavor extracts and synthetically derived flavor materials, which may be the reason why soft drinks are very attractive to this particular group. Beverages which are consumed often by the general public, especially at breakfast, are fruit juice products, particularly orange juice. Like milk, orange juice has a wholesome, nutritional image, but is generally considered to have a more appealing taste. Accordingly, soft drinks or fruit juice products nutritionally supplemented with calcium could be viewed as potential vehicles for achieving greater dietary calcium intake during this critical teenage/young adult period, and throughout life as well.

Nutritional supplementation of soft drinks, or other non-milk beverages like fruit juice, with significant levels of calcium is not straight forward. Milk contains, on average, about 0.12% calcium by weight. Inclusion of such a high level of calcium in a soft drink or other non-milk beverage requires consideration of a number of issues.

One is making sure that the calcium supplemented drink has desirable taste and mouthfeel qualities. It has been found that high levels of calcium can impart significant "astringency" mouthfeel sensations to a soft drink. This has been found to be especially true for soft drinks based on high levels of citric acid as the acidulant. In addition, it has been found that high levels of calcium can cause undesirable "biting/burning" mouthfeel sensations long after the soft drink is consumed. This "aftertaste" problem is especially true of soft drinks based on high levels of phosphoric acid as the acidulant.

Another factor which must be considered is the sourness impression of the soft drink. Calcium-containing soft drinks based on high levels of edible acids such as citric acid or phosphoric acid typically have a slower, more lingering onset of sourness. This is due to the ability of these acids to buffer the soft drink to a relatively high, though acidic pH. A quicker onset of sourness is usually desirable for certain soft drinks, in particular those having a cola-type flavor.

Another potential issue is precipitation of insoluble calcium salts such as calcium citrate and calcium phosphate. Stability against precipitation is a very significant problem for beverage concentrates used to

prepare soft drinks or other non-milk beverages like fruit juice ... use of the very high levels of calcium salts present. However, at even moderate concentrations in drink... beverages, stability against precipitation of insolubl calcium salts can be important, especially on ... ment surfaces during pasteurization or sterilization of calcium-containing fruit juice beverages.

BACKGROUND ART

U.S. Patent 4,325,975 to Lindon et al, issued April 20, 19... discloses mineralized drinking water formulations consisting essentially of strontium ions (20-40 mi... ns per liter), magnesium ions (50-100 milligrams per liter), calcium ions (60-125 milligrams per liter), ... thium Ions (0.06 to 0.15 milligrams per liter). These ions are added to distilled water in the form of wat... ble salts such as the sulfates, nitrates or chlorides.

U.S. Patent 4,448,770 to Epting, issued May 15, 1984, di... s a dietetic beverage containing, per gallon, 30 to 50 milliequivalents of potassium ion, 5 to 1... liequivalents of calcium ion, 1 to 3 milliequivalents of magnesium ion, and 5 to 10 ounces of suc... Suitable potassium salts include the sulfate, citrate, and preferably chloride salts. Suitable calcium s... s include the chloride and preferably gluconate salts. The magnesium ion is preferably supplied as the ... gnesium chloride salt.

U.S. Patent 4,322,407 to Ko, issued March 30, 1982, disclos... an electrolyte drink containing sodium, potassium, magnesium, chloride, sulfate, phosphate, citrate, suc... , dextrose, ascorbic acid and pyridoxine.

U.S. Patent 4,384,005 to McSweeney, issued May 17, 1983, d... oses compressed tablets which rapidly dissolve in water. These tablets can be used in beverage pre... tion. One such tablet (Example 4) is prepared from citric acid (580 grams), malic acid (70 grams), a... eous moistener (56 grams), corn syrup solids (55 grams), dextrin (25 grams), and calcium sulfate (20 g...

U.S. Patent 2,297,599 to Wilen, issued September 29, 1942, ... loses effervescent tablets consisting of an effervescent core and an outer layer containing a therapeut... ve together with an effervescent base. One such effervescent alkalizing tablet contains calcium gluco... sodium bicarbonate, potassium bicarbonate, magnesium sulfate, sodium chloride and an effervesc... ase of sodium bicarbonate, citric acid and tartaric acid.

DISCLOSURE OF THE INVENTION

The present invention relates to beverages, and beverage ... ntrates for preparing same, which are nutritionally supplemented with significant levels of calcium. ... beverages of the present invention comprise:

(a) from about 0.05 to about 0.15% by weight solubilized calcium;
(b) from about 0.07 to about 1% by weight of an edible acid com... ent;
(c) from about 0.02 to about 0.14% by weight sulfate;
(d) up to about 0.05% by weight chloride;
(e) the amount of sulfate and chloride combined being up to about ... .14% by weight;
(f) an effective amount of a flavor component; and
(g) an effective amount of a sweetener.

For the beverage concentrates of the present invention, the le... solubilized calcium is from about 0.15 to about 0.75% by weight, the level of the acid component is ... about 0.2 to about 5% by weight, the level of sulfate is from about 0.06 to about 0.7% by weight, t... el of chloride is up to about 0.25% by weight and the level of sulfate and chloride combined up to abo... % by weight.

The present invention further relates to fruit juice beverag... ich are nutritionally supplemented with significant levels of calcium. These fruit juice beverages compri...

(a) from about 0.05 to about 0.26% by weight solubilized calciu...
(b) from about 0.4 to about 4% by weight of an edible acid com... nt;
(c) from about 0.02 to about 0.1% by weight sulfate;
(d) up to about 0.07% by weight chloride;
(e) the amount of sulfate and chloride combined being up to ab... 12% by weight;
(f) at least about 45% fruit juice; and

(g) a sugar content of from about 2 to about 16° Brix.

For fruit juice concentrates of the present invention, the level of [illegible]ilized calcium is from about 0.15 to about 1.30% by weight, the level of the acid component is from [illegible] 1.2 to about 20% by weight, th level of sulfate is from about 0.06 to about 0.5% by weight, the level [illegible] chloride is up to about 0.35% by weight, the level of sulfate and chloride combined is up to about 0.6% [illegible] weight, and th sugar content is from about 6 to about 75° Brix.

The fruit juice and other beverages of the present invention su[illegible] significant levels of nutritionally beneficial calcium. Inclusion of low levels of sulfate (preferably in c[illegible]nation with low levels of chloride) improves the solubility of calcium in these beverages, and especial[illegible] concentrates for preparing these beverages, even when they contain high levels of citric acid or phosph[illegible]c acid. Certain of these beverages also have a quicker onset of sourness, even when acid systems such[illegible] citric acid or phosphoric acid are used, as well as reduced aftertaste. In addition, the sulfate/chloride [illegible]ces or prevents the precipitation and depositing of calcium salts on equipment surfaces during pas[illegible]zation or sterilization of calcium-containing fruit juice beverages.

A. Definitions

As used herein, the term "beverage" refers to a beverage com[illegible]tion which is in a single-strength, ready-to-serve, drinkable form. Beverages of the present invention[illegible]ypically comprise at least 80% (preferably at least 85%) water. Beverages contemplated within the s[illegible]e of the present invention include both carbonated and noncarbonated forms.

As used herein, the term "beverage concentrate" refers to a bev[illegible]e composition in liquid form used to prepare a drinkable beverage. Sugar-sweetened beverage concen[illegible]s within the scope of the present invention typically comprise from 30 to 70% (preferably from 40 to 60[illegible] water. They are usually formulated to provide drinkable beverages when diluted with 2 to 4 parts by weight[illegible]ater.

As used herein, the term "beverage syrup" refers to a beverage [illegible]ncentrate which further comprises sugar. Beverage syrups typically comprise from 30 to 70% by weight sug[illegible]ar.

As used herein, the term "fruit juice product" refers to both fr[illegible] juice beverages and fruit juice concentrates which comprise at least about 45% fruit juice.

As used herein, the term "fruit juice beverage" refers to a fruit [illegible]ice product which is in a single-strength, ready-to-serve, drinkable form. Fruit juice beverages of the present invention can be of the "full-strength" type which typically comprise at least about 95% fruit juice.

Fruit juice beverages within the scope of the present invention [illegible]o include extended juice products which are referred to as "nectars.". These extended juice products [illegible]ically comprise from about 50 to about 90% fruit juice. Preferred extended juice products comprise fro[illegible]out 50 to about 70% fruit juice.

As used herein, the term "fruit juice concentrate" refers to a frui[illegible] product which, when diluted with appropriate amount of water, forms drinkable fruit juice beverages. Fru[illegible]ice concentrates within the scope of the present invention are typically formulated to provide drinkable [illegible]verages when diluted with 2 to 4 parts by weight water.

As used herein, the term "concentrated fruit juice" refers to fruit ju[illegible] from which a portion of the water has been removed.

As used herein, the term "fruit juice materials" refers to concentrated fruit juice, plus other fruit juice materials such as fruit juice aroma and flavor volatiles, peel oils, and pa[illegible]p or pomace.

As used herein, the term "fruit juice" refers to citrus juices, nonci[illegible] juices such as apple juice, grape juice, pear juice, cherry juice, berry juice, pineapple juice, peach juice, [illegible]ricot juice, plum juice, prune juice, passion fruit juice, banana juice, and mixtures of these juices.

As used herein, the term "citrus juice" refers to fruit juices selec[illegible]m orange juice, lemon juice, lime juice, grapefruit juice, tangerine juice and mixtures thereof.

As used herein, the term "comprising" means various compone[illegible]an be conjointly employed in the beverages and beverage concentrates of the present invention. [illegible]ordingly, the term "comprising" encompasses the more restrictive terms "consisting essentially of" a[illegible]onsisting of."

All amounts of fruit juice referred to herein are on a single-strength[illegible]sis.

B. Calcium Levels, Acid Systems and Sulfate/Chloride Levels

The key nutritional component of the beverages and beverage concentrates of the present invention is calcium. Suitable sources of calcium include calcium carbonate, calcium sulfate, calcium chloride, calcium phosphate, calcium hydrogen phosphate and calcium dihydrogen phosphate, calcium hydroxide, as well as the respective sour salts of calcium, e.g., calcium citrate, calcium malate, calcium gluconate or calcium lactate. Mixtures of calcium carbonate (or calcium hydroxide) and calcium sulfate, which optionally and preferably include calcium chloride and/or calcium gluconate, are particularly preferred calcium sources. To be useful in the present invention, the calcium needs to be "solubilized", i.e., dissolved or suspended, in the beverage or beverage concentrate. Accordingly, the amount of calcium included in the beverages and beverage concentrates of the present invention will be referred to herein in terms of "solubilized calcium", i.e., the amount of calcium ion dissolved or suspended.

For beverages of the present invention, calcium is present in an amount of at least 0.05% by weight. This minimum level of calcium (about half of milk level) provides significant nutritional supplementation for the beverage. The maximum level of calcium is up to 0.26% by weight for fruit juice beverages and typically up to about 0.15% for other beverages. As the level of calcium in fruit juice beverages is increased much beyond 0.26% by weight (beyond 0.15% by weight for other beverages), satisfactory taste and stability properties become much more difficult to achieve. Preferably, the level of calcium in fruit juice beverages is from about 0.10 to 0.20% by weight which includes a preferred level, i.e., 0.12% by weight, and from about 0.055 to about 0.09% by weight for other beverages.

With regard to fruit juice concentrates used to prepare fruit juice beverages of the present invention, the amount of calcium present is from about 0.15% to about 1.3% by weight. For other beverage concentrates, the amount of calcium present is typically from about 0.05% to about 0.75% by weight. Typically, beverages of the present invention are prepared from 3-fold to 5-fold (5X) beverage concentrates. Accordingly, the level of solubilized calcium is preferably in the range of from about 0.3 to about 1% by weight for fruit juice concentrates and from about 0.16 to about 0.45% by weight for other beverage concentrates.

A key component for drinkable beverages and beverage concentrates of the present invention from the standpoint of stability against precipitation of insoluble calcium salts, taste/mouthfeel/aftertaste quality and desirable onset of sourness is the edible acid component (added as or from juice). This acid component comprises one or more edible acids, which can include phosphoric acid, citric acid, malic acid, fumaric acid, adipic acid, lactic acid, tartaric acid, gluconic acid or mixtures thereof. These acids can be present in their undisassociated form or else as the respective sour salts, i.e. phosphate, hydrogen phosphate, dihydrogen phosphate, citrate, malate, tartrate, gluconate and the like. Particularly preferred edible acid systems comprise phosphoric acid, citric acid, malic acid, gluconic acid or combinations thereof.

For the purposes of the present invention, the level of total acid component (hereafter total acids) depends on the beverage composition involved, the level of calcium included, as well as the mouthfeel, taste and stability properties desired. For fruit juice beverages having from about 0.05 to about 0.26% by weight solubilized calcium, the level of total acids can range from about 0.4 to about 4% by weight. (For fruit juice concentrates used to prepare such beverages, the level of total acids can range from about 1.2 to about 20% by weight). For other beverages having from about 0.05 to about 0.15% by weight solubilized calcium, the level of total acids can range from about 0.4% to about 1% by weight. (For beverage concentrates used to prepare such beverages, the level of total acids can range from about 0.2 to about 5% by weight.) For preferred fruit beverages having from about 0.09 to about 0.20% by weight solubilized calcium, the level of total acids preferably ranges from 0.6 to 2% by weight (from about 1.8 to about 10% by weight for fruit juice concentrates used to prepare these fruit juice beverages). For other preferred beverages having from about 0.055 to about 0.09% by weight solubilized calcium, the level of total acids preferably ranges from 0.1 to 0.6% by weight (from about 0.3% to about 3% by weight for beverage concentrates used to prepare these beverages).

An important component for the beverages and beverage concentrates of the present invention is the level of sulfate present. Inclusion of low levels of sulfate (preferably in combination with low levels of chloride) in beverages of the present invention has been found to have several particularly important effects. One is to cause a quicker onset of sourness in certain beverages, especially those beverages having from about 0.055 to about 0.09% by weight solubilized calcium. This is believed to be due to a reduction in the buffering capacity of the edible acids present. (Chloride is believed to aid the quicker onset of sourness due to a taste mechanism interaction.) Another important effect is improving the solubility of calcium in the beverage/ concentrate, even where high levels of citric or phosphoric acid are used. This is also believed to be due to a reduction in the buffering capacity of the edible acids present. Another benefit

is a reduction in aftertaste effects, particularly the "biting/burning" aftertaste associated with calcium-fortified beverages containing phosphoric acid. This aftertaste is believed to be due to delayed precipitation of calcium phosphate in the mouth. The reduction in aftertaste due to citrate/chloride inclusion is believed to be the result of reduced calcium-phosphate interactions due to the common-ion-in-pH.

For fruit juice beverages having from about 0.05 to about 0.26% by weight solubilized calcium, the level of sulfate can range from about 0.02 to about 0.1% by weight, while the level of chloride can range up to about 0.07% by weight. (For fruit juice concentrates used to prepare such beverages, the level of sulfate can range from about 0.06 to about 0.5% by weight, while the level of chloride can range up to about 0.35% by weight.) For other beverages having from about 0.05 to about 0.15% by weight solubilized calcium, the level of sulfate can range from about 0.02 to about 0.14% by weight, while the level of chloride can range up to about 0.05%. (For beverage concentrates used to prepare these other beverages, the level of sulfate can range from about 0.06 to about 0.7% by weight, while the level of chloride can range up to about 0.25% by weight.) At sulfate levels much above 0.10% by weight or chloride levels much above 0.07% by weight, in juice beverages (above 0.14% by weight or 0.35% by weight, respectively, in other beverages), the sulfate and chloride concentrations are sufficiently high to cause a noticeable salty/brackish note which is considered undesirable. At sulfate levels much below 0.02% by weight, the effect of sulfate on sourness, aftertaste and improved solubility of calcium is significantly minimized. In addition, the amount of sulfate and chloride combined should be no more than about 0.12% by weight for fruit juice beverages of the present invention, and no more than about 0.6% by weight for fruit juice concentrates. For other beverages, the combined amount of sulfate and chloride should be no more than about 0.14% by weight (preferably no more than about 0.10% by weight), and no more than about 0.7% by weight (preferably no more than 0.5% by weight) for beverage concentrates used to prepare such beverages.

Sources of sulfate and chloride for inclusion in beverages and beverage concentrates of the present invention can be from sulfuric acid or hydrochloric acid, or salts such as calcium sulfate and calcium chloride. Preferably, the sulfate and chloride are derived from calcium sulfate and calcium chloride, which also serve as at least partial sources of calcium. Calcium sulfate and calcium chloride combined can supply from about 3.2 to 100% by weight of the solubilized calcium for fruit juice beverages/concentrates and from about 5.6 to 100% by weight of the solubilized calcium for other beverages/concentrates. Preferably, calcium sulfate and calcium chloride combined supply from about 10 to about 60% of the solubilized calcium present in fruit juice beverages/concentrates and from about 9 to 89% of the solubilized calcium present in other beverages/concentrates.

C. Other Components of Beverages and Beverage Concentrates

1. Fruit Juice Beverages and Juice Concentrates

The fruit juice beverages and juice concentrates of the present invention also contain the sugars normally present in fruit juice products. These sugars include sucrose, fructose, high fructose corn syrup, glucose, invert sugar, and mixtures thereof. The amount of sugar naturally present in fruit juices is usually sufficient for the calcium-supplemented fruit juice beverages and juice concentrates of the present invention. However, in the case of extended juice products, sugar is usually added, usually in the form of sucrose or high fructose corn syrup.

In addition to sugar, extended fruit juice beverages of the present invention can contain other sweeteners. Other suitable sweeteners include saccharin, cyclamates, acetosulfam, L-aspartyl-L-phenylanine lower alkyl ester sweeteners (e.g. aspartame), L-aspartyl-L-alanine amides disclosed in U.S. Patent 4,411,925 to Brennan et al. issued October 23, 1983 (herein incorporated by reference), L-aspartyl-D-serine amides disclosed in U.S. Patent 4,399,163 to Brennan et al. issued August 16, 1983 (herein incorporated by reference), L-aspartyl-L-1-hydroxymethylalkaneamide sweeteners disclosed in U.S. Patent 4,338,346 to Brand, issued December 21, 1982 (herein incorporated by reference), L-aspartyl-1-hydroxyethylalkaneamide sweeteners disclosed in U.S. Patent 4,423,029 to Rizzi, issued Dec. 27, 1983 (herein incorporated by reference), L-aspartyl-D-phenylglycine ester and amide sweeteners disclosed in European Patent Application 168,112 to J. M. Janusz, published January 15, 1986 (herein incorporated by reference), and the like. A particularly preferred sweetener for use in such extended juice products is aspartame.

For single-strength fruit juice beverages, the sugar content can range from about 2 to about 16° Brix. Typically, the sugar content of such beverages depends upon the amount of fruit juice contained therein.

For full-strength beverages containing at least about 95% fruit ... the sugar content is typically from about 5 to about 14° Brix. For extended juice beverages which ... prise from about 50 to about 90% fruit juice, the sugar content is typically from about 5 to about 13° ... no other sweeten r) or from about 2 to about 8° Brix (other sweetener containing).

For fruit juice concentrates according to the present invent... sugar content can range from about 6 to about 75° Brix. Typically, th sugar content of these juice ... ntrates is from about 20 to about 50° Brix. For orange juice concentrates, the sugar content is preferably ... in about 35° to about 50° Brix.

The fruit juice beverages and juice concentrates of the pres... vention are typically substantially free of added protein. Examples of such proteins include soy prote... hey protein concentrate, and the like. These proteins can react with fruit juice aromas and flavors ... if hydrolyzed, can form short-chain peptides or amino acids which have undesirable bitter flavors. ... fruit juice beverages of the present invention, the amount of added protein is generally no more tha... about 0.1% by weight. Preferably, these beverages and concentrates contain no added protein.

Other optional ingredients typically present in fruit juice proc... can be included in the beverages and concentrates of the present invention. For example, preserv... vitamins and other minerals can be included. Suitable vitamins include A, D, E, C (ascorbic acid), ... amin), B_2 (riboflavin), B_6, B_{12}, niacin, folic acid and biotin. Other minerals besides calcium which ... included are iron, zinc, potassium, magnesium, manganese and copper. If desired, natural and ... tic flavorings and colorings can be included in these beverages and concentrates.

2. Other Beverages and Beverage Concentrates

a. Flavor Component

Other beverages and beverage concentrates of the pr... invention typically comprise a flavor component which contains a flavor selected from fruit flavors ... ical flavors and mixtures thereof. As used herein, the term "fruit flavor" refers to those flavors der... rom the edible reproductive part of a seed plant, especially one having a sweet pulp associated with t... d. Also included within the term "fruit flavor" are synthetically prepared flavors made to simulate fr... lavors derived from natural sources. Particularly preferred fruit flavors are the citrus flavors including ... nge flavors, lemon flavors, lime flavors and grapefruit flavors. Besides citrus flavors, a variety of othe... t flavors can be used such as apple flavors, grape flavors, cherry flavors, pineapple flavors and the li... These fruit flavors can be derived from natural sources such as fruit juices and flavor oils, or else synthetically prepared.

As used herein, the term "botanical flavor" refers to flavors d... ed from parts of a plant other than the fruit. As such, botanical flavors can include those flavors deriv... m nuts, bark, roots and leaves. Also included within the term "botanical flavor" are synthetically pr... ed flavors made to simulate botanical flavors derived from natural sources. Examples of such flavors ... e kola flavors, tea flavors, and the like. These botanical flavors can be derived from natural sources s... ssential oils and extracts, or else can be synthetically prepared.

The flavor component can comprise a blend of various fla... , lemon and lime flavors, kola flavors with citrus flavors to form cola flavors, etc. If desired, fruit ju... h as orange juice, lemon juice, lime juice, apple juice, grape juice and the like can be used in th... component. The flavors in the flavor component are sometimes formed into emulsion droplets ... are then dispersed in the beverag concentrate. Because these droplets usually have a specific ... y less than that of water and would therefore form a separate phase, weighting agents (which ca... act as clouding agents) are typically used to keep the emulsion droplets dispersed in the bevera... amples of such weighting agents are brominated vegetable oils (BVO) and rosin esters, in par... the ester gums. See L. F. Green, Developments In Soft Drinks Technology, Vol. 1, (Applied Sci... ublishers Ltd. 1978), pp. 87-93 (herein incorporated by reference), for a further description of the us... ighting and clouding agents in liquid beverages. Besides weighting agents, emulsifiers and emuls... bilizers can be used to stabilize the emulsion droplets. Examples of such emulsifiers and emu... abilizers include the gums, p ctins, celluloses, polysorbates, sorbitan esters and propylene glycol ... s. See L. F. Green, supra at p. 92.

The particular amount of the flavor component effectiv... mparting flavor characteristics to the beverages and beverage concentrates of the present inventio... vor enhancing") can depend upon the flavor(s) selected, the flavor impression desired, and the ... of the flavor component. For flavor

components which are substantially free of fruit juice, i.e., on a single-strength basis, no more than about 1% fruit juice by weight of the beverage, the flavor component comprise at least about 0.05% by weight of the beverage composition, and typically from about 0.1 to about 2% by weight for carbonated beverages. When fruit juices are used, the flavor component can comprise, on a single-strength basis, up to about 40% fruit juice by weight of the beverage, preferably from about 5% to about 15% fruit juice by weight for carbonated beverages.

b. Sweeteners

Beverages and beverage syrups of the present invention contain a sweetener. The sweetener typically used is sugar. As used herein, the term "sugar" refers to mono- and disaccharide sweeteners. Examples of such sugars include sucrose, glucose, fructose, high fructose corn syrup, invert sugar and the like. Preferred sugars are sucrose and high fructose corn syrup. Sugars, especially high fructose corn syrup, have been found to enhance the absorbability/bioavailability of certain components from beverages of the present invention.

For diet beverages, noncaloric sweeteners can be used. Examples of such sweeteners include saccharin, cyclamates, acetosulfam, L-aspartyl-L-phenylalanine lower alkyl ester sweeteners, L-aspartyl-D-alanine amides disclosed in U.S. Patent 4,411,925 to Brennan et al., issued October 23, 1983 (herein incorporated by reference), L-aspartyl-D-serine amides disclosed in U.S. Patent 4,399,163 to Brennan et al., issued August 16, 1983 (herein incorporated by reference), L-aspartyl-L-1-hydroxymethylalkaneamide sweeteners disclosed in U.S. Patent 4,338,346 to Brand, issued December 21, 1982 (herein incorporated by reference), L-aspartyl-1-hydroxyethylalkaneamide sweeteners disclosed in U.S. Patent 4,423,029 to Rizzi, issued December 27, 1983 (herein incorporated by reference), and the like. The acid systems of the present invention can provide improved hydrolytic stability for beverages containing L-aspartyl-L-phenylalanine ester (e.g. aspartame) sweeteners in the critical pH range from about 4.0 to about 4.8.

The amount of the sweetener effective in the beverages of the present invention depends upon the particular sweetener(s) used and the sweetness intensity desired. For noncaloric sweeteners, this amount varies depending upon the sweetness intensity of the particular sweetener. For sugar, this amount can be from about 1 to about 14% (typically from about 6 to about 14%) by weight for carbonated beverages. Preferred beverages contain from about 9 to about 13% by weight sugar. (In determining the amount of sugar for beverages of the present invention, any sugar or other sweetener present in the flavor component, such as in fruit juice, is also included.) Low-calorie sweetener combinations containing a noncaloric sweetener such as aspartame and a sugar such as high fructose corn syrup can also be used in beverages of the present invention. For beverage syrups of the present invention, the amount of sugar is significantly higher. Usually, the amount of sugar in a beverage syrup is from about 30 to about 70% by weight. Preferably, such beverage syrups contain from about 40 to about 60% by weight sugar.

The beverages, beverage concentrates and beverage syrups of the present invention are typically substantially free of a sugar alcohol, i.e. less than about 1% by weight. Such sugar alcohols include sorbitol, mannitol and xylitol. Sugar alcohols are sometimes used as sweeteners for food products. However, these sugar alcohols, which are noncaloric, are also metabolized by lower gut flora, causing flatulence and related gastrointestinal (GI) tract problems such as diarrhea. Accordingly, at the levels required to sweeten beverages, sugar alcohols are not particularly useful in the present invention.

c. pH and Other Beverage Ingredients

The pH of other beverages and beverage concentrates of the present invention is dependent upon the particular composition of the acid component, the total amount of acid and the sourness impression desired. Typically, the pH can range from about 2.5 to about 5.0. For carbonated beverages have a ph of from about 2.5 to about 4.5.

Other minor beverage ingredients are frequently included in beverages and concentrates. Such ingredients include preservatives such as benzoic acid and salts thereof, sulfur dioxide, etc. Also, typically included are colors derived either from natural sources or synthetically prepared. See L. F. Green, Developments in Soft Drinks Technology, Vol. 1 (Applied Science Publishers Ltd. 1978), pp. 185-186 (herein incorporated by reference) for preservatives and colors used in beverages.

D. Preparation of Beverages and Beverage Concentrates

1. Fruit Juice Beverages and Juice Concentrates

Calcium sulfate, and calcium chloride and/or calcium glu... usually do not supply 100% of the solubilized calcium for calcium-supplemented fruit juice bever... d juice concentrates of the present invention. Other calcium sources, in particular, calcium hydroxid... m oxide and calcium carbonate, are typically used in addition to calcium sulfate, and calcium chl... or calcium gluconate. These other calcium sources are preferably included in these fruit juice bev... nd juice concentrates by using what is referred to hereafter as a premix method. The following dis... f this method will generally be with regard to formation of orange juice beverages and juice conc... which are high preferred fruit juice products according to the present invention. However, this m... also be used to prepare calcium-supplemented fruit juice products based on other citrus juices s... grapefruit juice, noncitrus juices such as apple juice, as well as mixtures of juices.

In this premix method, an acid component comprising citric ... d malic acid is typically dissolved in the appropriate quantity of water. (If desired, fruit juice or con... e fruit juice such as lemon juice can be used to supply a portion of the acids). Generally, this acid ... ent comprises from 0 to about 90% by weight citric acid and from about 10 to 100% by weig... c acid. For orange juice, this acid component typically comprises from about 5 to about 90% by ... itric acid and from about 10 to about 95% by weight malic acid. Preferably, this acid component com... om about 5 to about 60% by weight citric acid and from about 40 to about 95% by weight malic ac... oncitrus juices such as apple juice, this acid component typically comprises from about 5 to about ... weight citric acid and from about 20 to about 95% by weight malic acid, and preferably comprises ... out 20 to about 50% by weight citric acid and from about 50 to about 80% by weight malic acid.) A... he ratio of these acids is selected to provide optimum flavor character in the juice.

Once the solution containing the dissolved acids is form... alcium hydroxide, calcium oxide or calcium carbonate is then added. The weight ratio of total acids ... um added in the solution is typically from about 0.5 to about 12. Preferably, this weight ratio is from ... o about 6.

Addition of calcium carbonate, calcium oxide, or calcium ... de to the aqueous solution of acids provides a premix containing an at least meta-stable solution of ... ized calcium. This is due to the fact that highly soluble calcium citrate and malate species such as ... rate, $Ca(H_2$ citrate$)_2$, and CaHmalat are formed in the solution due to the reaction between the c... ource and the acids. Without added stabilizers, the highly soluble calcium citrate species are stable ... premix solution for periods up to only about a few hours. After this short period of time, the highly sol... rate species tend to disproportionate to the corresponding acid and the more thermodynamically st... soluble calcium citrate salts, such as Ca_3 citrate$_2$.

To improve the stability of the calcium malate and especia... e species in the premix solution, it is preferred to include a premix stabilizer. Materials which can co... with calcium and/or act as crystallization inhibitors are useful as premix stabilizers. These material... de sugars, such as sucrose, glucose, fructose, high fructose corn syrup, invert sugar, and polysac... such as pectin, algins, hydrolyzed starches, xanthan gum, and other edible gums. Concentrated ju... ich naturally contain both sugars and polysaccharides are particularly suitable premix stabilizers. F... premix stabilizers are sucrose and high fructose corn syrup (especially for extended juice produ... concentrated orange juice having a sugar content of from about 35 to about 80° Brix whose source ... ribed hereafter.

The premix stabilizer can be added immediately after t... m source is added to the aqueous solution containing the acids. (When calcium carbonate is the ... source, carbon dioxide evolution is preferably allowed to substantially cease before the premix ... is added). However, if desired, the premix stabilizer (especially in the case of sugars and conc... ice) can be added to the aqueous solution of the acids prior to addition of the calcium source. T... t of premix stabilizer included in the premix solution typically depends upon the stablizer used. W... s are used as the premix stabilizer, they are typically added in an amount sufficient to provide a ... ntent of from about 2 to about 40° Brix. When polysaccharides are used, the amount can vary wi... s typically from about 0.01 to about 0.5% on a weight/volume basis. When concentrated juice is ... the premix stabilizer, it is typically included in an amount sufficient to provide a sugar content ... out 2 to about 12° Brix (preferably from about 2 to about 6° Brix).

The premix solution of solubilized calcium is typically ... in a batch-typ fashion, as in the

description above, at room temperature. However, this premix soluti... also be prepared in a continuous fashion. In this continuous method, the ingredients (water, acids, ...n source and optional premix stabilizer) are constantly metered together to form the premix sol... level at which the ingredients are m tered is adjusted, as necessary, to insure appropriate sol... ...of the calcium in th premix solution and to provide the appropriate acidity.

The premix solution containing the solubilized calcium is co... ...n a mix tank with chilled (e.g., below about 40° F (4.4° C)) concentrated orange juice having a sug... ...t of from about 35 to about 80° Brix (preferably from about 60 to about 70° Brix.), orange juic... and flavor volatiles, plus other orange juice materials such as pulp and peel oils, to provide ... ...ium-supplemented orange juice products. The particular proportions of premix solution, concentrat... ...aroma and flavor volatiles, pulp and peel oils used will depend upon a number of different fa... ...cluding the degree of calcium supplementation desired and the type of orange juice product in... ...ingle-strength juice beverage or juice concentrate). Calcium sulfate, and calcium chloride and/or c... ...gluconate, can also be added to the mix tank or else can be included in the premix solution. Afte... ...cium-supplemented orange juice product is obtained, it is then filled into cans, cartons, bottles or ot... ...opriate packaging. In the case of calcium-supplemented orange juice concentrates, these products ... ...ally frozen after being filled into cans.

Inclusion of calcium sulfate and calcium chloride in calcium-... ...g fruit juice beverages helps in reducing or preventing the precipitation of calcium salts (especially ... ...n citrate) on equipment surfaces during pasteurization or sterilization. It has been surprisingly foun... ...s a calcium-containing fruit juice stream passes through pasteurization or sterilization equipment, ...lcium salts present in the juice stream precipitate out at the high temperatures (e.g., from abo... ...° to about 300° F) required for pasteurization or sterilization. These precipitated calcium salts typica... ...posit on the equipment surface of the pasteurizer or sterilizer and eventually flake off into the fin... ...roduct stream. Pasteurization or sterilization equipment in which such precipitation problems can oc... ...ude ultra-high temperature direct stream infusion sterilizers such as the Crepaco Ultratherm Infusion

The concentrated orange juice, orange juice aroma and flavor ... ...s, pulp and peel oils used in the method of the present invention can be obtained from standard c... ...ice processing. See Nagy et al., Citrus Science and Technology, Volume 2, (AVI Publishing Co. 1... ...177-252 (herein incorporated by reference) for standard processing of oranges, grapefruit and tan... ... (See also Nelson et al, Fruit & Vegetable Juice Processing Technology (3rd Ed., AVI Publishing ... ...pp. 180-505 (herein incorporated by reference) for standard processing of noncitrus juices such as ... ...ice, grape juice, pineapple juice, etc. to provide sources of juice and juice materials for calcium-s... ...ented noncitrus juice products.) Fresh juice is extracted from the oranges, principally of the Val... ...pe. (The peel of the oranges is initially rasped to provide peel oils which can be used in the meth... ...e present invention). Juices from different oranges are frequently blended to adjust the sugar to acid ... ...sugar to acid ratio of from about 8:1 to about 20:1 is considered acceptable. However, preferred su... ...id ratios are typically from about 11:1 to about 15:1.

Juice is extracted from the oranges by using automatic ju... ...achines, or less often by hand squeezing of the oranges. The type of equipment used to extra... ...ice is not critical. The raw juice exiting from the squeezing device contains pulp, rag and seeds. T... ...nd seed are separated from the juice and pulp in a finisher. The juice is then typically separated ... ...ulp portion and a serum portion. (The pulp portion can be used as a source of pulp in the method of ... ...esent invention).

The serum portion can be concentrated by a variety of techni... ...hich typically include evaporative concentration or freeze concentration. In evaporative concentration, ...um portion of the juice is passed through an evaporator (e.g. falling film or temperature accelerat... ...time evaporator (TASTE) type). Water vapor, as well as the aroma and flavor volatiles, are stripp... ...he juice. These stripped volatiles are then centrifuged to provide an upper layer (essence oils) a... ...ver layer (aqueous essence). (A portion of these essence oils and aqueous essence are typically u... ...he source of orange juice aroma and flavor volatiles for the method of the present invention). ...maining stripped juice is then concentrated in the evaporator (by heat) to the appropriate amo... ...olids as measured by the sugar content of the concentrated juice. This concentrated juice can ... ...used in the method of pr sent invention.

Most concentrated orange juices are obtained by evaporative ... ...tion. However, freeze concentration can also be used to obtain concentrated orange juice usefu... ...method of the present invention. Freeze concentration typically involves passing the serum portio... ...uice through a scraped wall heat

exchanger to form substantially pure ice crystals which are th... parated from th concentrated juice. A preferred freeze concentration method is disclosed in U.S. Pat... 74,865 to Strobel, issued February 22, 1983, which is incorporated by reference. Unlike evaporati... centration, concentrated orange juice obtained by fr ze conc ntration typically contains the aroma ... or volatil s as well.

2. Other Beverages and Beverage Concentrates

The other beverages and concentrates of the present inv... an be prepared by standard beverage formulation techniques. Although noncarbonated beverages ar... n the scope of the present invention, particular emphasis is given to the making of carbonated bev... It should be understood, however, that carbonated beverage making techniques, when appropriate... ified, are also applicable to noncarbonated beverages. Also, while the following description is ... erence to sugar containing beverages, diet beverages containing noncaloric sweeteners can also be pr... d by appropriate modification.

In making a sugar-sweetened carbonated beverage, a b... e concentrate is usually formed. This beverage concentrate typically contains the emulsified or wate... le flavors, emulsion stabilizing agents, and weighting agents if needed, any color desired and suit... reservatives. After the concentrate is formed, sugar and water are then added to make a beverage s... This beverage syrup is then mixed with an appropriate quantity of water to form the finished bever... e weight ratio of water: syrup is from about 2:1 (3X syrup) to about 4:1 (5X syrup). Carbon dioxide ... introduced either into the water mixed with the beverage syrup or into the drinkable beverage to a ... carbonation. The carbonated beverage can then be placed in a container such as a bottle or can and... ealed. See L. F. Green, Developments In Soft Drinks Technology, Vol. 1, (Applied Science Publishe... 978), pp. 102-107 (herein incorporated by reference), for a further description of beverage making, in ... ar the process for carbonation.

The amount of carbon dioxide introduced into the bev... an depend upon the particular flavor system used and the amount of carbonation desired. Us... arbonated beverages of the present invention contain from about 1.0 to about 4.5 volumes of car... oxide. Preferred carbonated beverages contain from about 2 to about 3.5 volumes of carbon dioxide.

The calcium source(s) (e.g. calcium carbonate, calcium ... and calcium chloride) and the acids (e.g., citric, malic, and phosphoric) can be added at various ... in this beverage concentrate-beverage syrup-carbonated beverage making process. The calcium s... nd acids are preferably added at the same point in this process, but can also be added at differen... Usually, the calcium source and acids are included during preparation of the beverage concentrate c... preparation of the beverage syrup.

Specific Embodiments of Beverages, Beverage Concentrates ... ethods for Making Same According to the Present Invention

The following are specific embodiments of beverages, bev... syrups and methods for making same in accordance with the present invention:

Embodiment 1

A cola-flavored beverage syrup was prepared from the ic... ngredients:

Ingredient	Am
Water	24
Calcium hydroxide	
Calcium chloride dihydrate	
Calcium sulfate dihydrate	
Phosphoric acid (85%)	
High fructose corn syrup 55	22
Cola flavor and caramel	
Total	48

The ingredients were mixed together to form the syrup. The syrup was added to 10 oz. bottles (90 g. of syrup in each bottle). The bottles were then cooled to 34° F. Carbonated water (4.95 volumes CO_2) was added to make a final volume in each bottle of 10 oz.

Embodiment 2

A lemon/lime-flavored beverage was prepared from the following ingredients:

Ingredient	Amo
Water	12
Calcium carbonate	
Calcium sulfate	
Calcium chloride dihydrate	
Citric acid (anhydrous)	
High fructose corn syrup 55	2
Total	15

The above ingredients were mixed together and then 1.67 ml of lemon/lime flavor and 2.4 ml of color were added and mixed. The beverage was added to 16 oz. bottles (in each bottle). The bottles were carbonated to 3.5 volumes CO_2. The beverage had a pH of 3.56.

Embodiment 3

The lemon/lime-flavored beverage was prepared from the following ingredients:

Ingredient	Am
Water	
Calcium hydroxide	
Calcium chloride dihydrate	
Calcium sulfate	
Citric acid (anhydrous)	
Malic acid	
High fructose corn syrup 55	1
Total	10

The above ingredients were mixed together and then added to 16 oz. bottles (about 500 g. in each bottle). To each bottle was added 0.53 ml of lemon/lime flavor and 0.7 of color. The bottles were then carbonated to 3.0 volumes CO_2.

For Embodiments 1 to 3, the level of calcium, total acids and chloride in the beverage is shown in the following table:

Embodiment	Calcium (%)	Total Acids (%)	Chloride (%)
1	0.055	0.111	0.024
2	0.060	0.25	0.027
3	0.056	0.192	0.024

Embodiment 4

An acid/calcium mixture comprising 275 lbs. of tap water s. of malic acid, 0.59 lbs. of citric acid, 5.9 lbs. of calcium hydroxide and 2.89 lbs. of calcium sulfat alf hydrate was prepared in a stainless steel tank. In a separate blending tank, 450 lbs. of 65° Brix ora ice concentrate was blended with 1400 lbs. of water. The acid/calcium mixture was added to the large ing tank containing diluted concentrate. More water was then added to provide a juice solids conte 4° Brix. The calcium-containing juice mixture (2250 lbs.) was pasteurized using a Crepaco Ultrather sion Heater at a temperature of 230° F and at a rate of 22 lbs. of juice per minute. The residence tim 2 to 4 seconds in the Infusion Heater. The pH of pasteurized juice was 3.85. The inside wall of the Heater was inspected after the run. No precipitate or deposit of calcium salt was observed.

In a separate control run, an acid/calcium mixture compri 5 lbs. of water, 12.75 lbs. of malic acid, 0.74 lbs. of citric acid and 7.38 lbs. of calcium hydroxide wa to the same orange juice concentrate. The diluted juice/acid/calcium mixture was pasteurized usi ame Infusion Heater under the same processing conditions. The final pH of pasteurized juice wa mined to be 4.15. Severe deposits of calcium salt was noticed inside the Infusion Heater after the r

Both runs were prepared to deliver 300 mg. of calcium per of juice.

Embodiment 5

An acid premix containing 275 lbs. of water, 7.6 lbs. of cid, 0.39 lbs. of citric acid, 5.2 lbs. of calcium hydroxide, 2.96 lbs. of calcium chloride dihydrate a lbs. of calcium sulfate (anhydrous) was blended into a batch of orange juice as in Embodiment 4. calcium/juice mixture was pasteurized using a Crepaco Ultratherm Infusion Heater in the same m s Embodiment 4. The final pH of the product was determined to be 3.65. No precipitate or deposi bserved inside the Infusion Heater after the run. This formula also delivered 300 mg. of calcium per 8 uice.

Embodiment 6

An acid/calcium mixture comprising 300 lbs. of distilled 0.2 lbs. of malic acid, 0.59 lbs. of citric acid, 5.9 lbs. of calcium hydroxide, 4.25 lbs. of calcium glu nd 1.46 lbs. of calcium sulfate one half hydrate was blended into a batch of orange juice as in Em t 4. Sufficient water was then added to provide a juice solids content of 14.2 ° Brix. The acid/cal e mixture was then pasteurized as in Embodiment 4. The final pH of this product was 3.70. N te or deposit was observed inside the Infusion Heater after the run. The product delivered 300 mg m per 6 oz. of juice. The flavor of the pasteurized juice was judged to be equal to a regular ora e (without calcium salts) by untrained panelists.

Claims

1. A calcium-supplemented beverage, which comprises:
(a) from 0.05% to 0.15% by weight solubilized calcium, preferably [illegible]055% to 0.09% by w ight;
(b) from 0.07% to 1% by weight of an edible acid component, p[illegible]ly from 0.1% to 0.6% by weight; preferably said acid component comprises citric acid, malic acid, p[illegible]ric acid or mixtures thereof.
(c) from 0.02% to 0.14% by weight sulfate;
(d) up to 0.05% by weight chloride;
(e) the amount of sulfate and chloride combined being no more th[illegible]% by weight, preferably no more than 0.10%;
(f) at least 0.5% of a flavor component; and
(g) from 1% to 14% sweetener, selected from sugar, high fructo[illegible] syrup, a non-caloric sweetener, preferably aspartame, and mixtures thereof.

2. The beverage of Claim 1 which is carbonated with from [illegible] 4.5 volumes of carbon dioxide, preferably from 2 to 3.5 volumes.

3. The carbonated beverage of Claims 1 or 2 wherein said [illegible]mponent comprises from 5% to 15% fruit juice by weight of the beverage.

4. A beverage concentrate in liquid form for preparing a drinka[illegible]rage, which comprises:
(a) from 0.15% to 0.75% by weight solubilized calcium, preferably [illegible]6% to 0.45% by weight;
(b) from 0.2% to 5% by weight of an edible acid component, [illegible]bly from 0.3% to 3% by weight; preferably said acid component comprises citric acid, malic acid, p[illegible]ric acid or mixtures thereof.
(c) from 0.06% to 0.7% by weight sulfate;
(d) up to 0.25% by weight chloride;
(e) the amount of said sulfate and said chloride combined being [illegible]0.7% by weight, preferably up to 0.5% by weight;
(f) at least 0.5% flavor component; and
(g) from 30% to 70% water.

5. The concentrate of Claim 4 which further comprises from [illegible]70% by weight sugar, preferably high fructose corn syrup.

6. A calcium-supplemented single-strength fruit juice beverage [illegible]comprises:
(a) from 0.05% to 0.26% by weight solubilized calcium, preferably [illegible]10% to 0.20% by weight;
(b) from 0.4% to 4% by weight of an edible acid component, prefe[illegible]m 0.6% to 2% by weight;
(c) from 0.02% to 0.1% by weight sulfate;
(d) up to 0.07% by weight chloride;
(e) the amount of sulfate and chloride combined being up to 0.12%[illegible]ight;
(f) from 45% to 90% fruit juice, preferably citrus juice, orange juic[illegible]fruit juice, or apple juice;
(g) a sugar content of from 2° to 16° Brix, preferably from 2° to [illegible]

7. The beverage of Claim 6 wherein said acid component co[illegible]a mixture of citric acid, malic acid and gluconic acid.

8. A calcium-supplemented fruit juice concentrate, which com[illegible]
(a) from 0.15% to 1.30% by weight solubilized calcium, preferably [illegible]3% to 1.0% by weight;
(b) from 1.2% to 20% by weight of an edible acid component, pre[illegible]rom 1.8% to 10% by weight;
(c) from 0.06% to 0.5% by weight sulfate;
(d) up to 0.35% by weight chloride;
(e) the amount of said sulfate and said chloride combined being u[illegible]% by weight;
(f) at least 45% fruit juice, preferably citrus juice; and
(g) a sugar content of from 6° to 75° Brix.

9. The concentrate of Claim 8 which has been frozen and wh[illegible]id citrus juice is orange juice and comprises at least 95% of the concentrate.

10. The concentrate of Claim 8 wherein said orange juic[illegible]rises from 50% to 90% of the concentrate.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 20 1562

DOCUMENTS CONSIDERED TO BE RELEV...

Category	Citation of document with indication, where appropriate, of relevant passages	...elevant ... claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.3)
X	EP-A-0 227 174 (PROCTER & GAMBLE CO.) * page 11, embodiment 5; claims 1-10 * ---	5,9	A 23 L 2/26
X,P	EP-A-0 244 903 (PROCTER & GAMBLE CO.) * page 11, embodiment 1; claims 1-19 * ---	5,9	
A	US-A-3 657 424 (C.O. AKTINS et al.) * claims 1-9 * ---	4	
D,A	US-A-4 448 770 (E.E. EPTING) * abstract * ---		
D,A	US-A-4 322 407 (S.Y. KO) * claims 1-9 * -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.3)

A 23 L 2/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	27-10-1988	SCHULTZE D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or p... 'erlying the invention
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